

STRUCTURAL CHANGES DURING THE WEAR OF DIAMONDLIKE CARBON FILMS AT LOW TEMPERATURE

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Abstract

Visible Raman spectroscopy was used to investigate structural changes in diamondlike carbon films worn against steel and diamondlike carbon-coated counterfaces at temperatures ranging from -40°C to $+20^{\circ}\text{C}$. The shape of the D and G peaks remained approximately constant in the worn areas of the film, but once the film had worn away the peak shapes in the wear debris spectra were much sharper. This indicates little or no change in crystallinity with wear until the film is removed, when it becomes more crystalline. The ratio of D to G peak height and area in the worn areas remained approximately constant as well, indicating little change in overall structure (Figure 1). These phenomena were independent of wear test temperature or counterface material. This was not expected, since the predominant wear mechanism changed markedly with temperature and counterface material, as shown by changes in wear rate, friction coefficient, and wear track morphology [1]. However, changes in photoluminescent background may indicate more subtle structural or compositional changes taking place during the wear process [2]. These bear directly on the functionality of these and similar films for low-temperature unlubricated tribological applications.

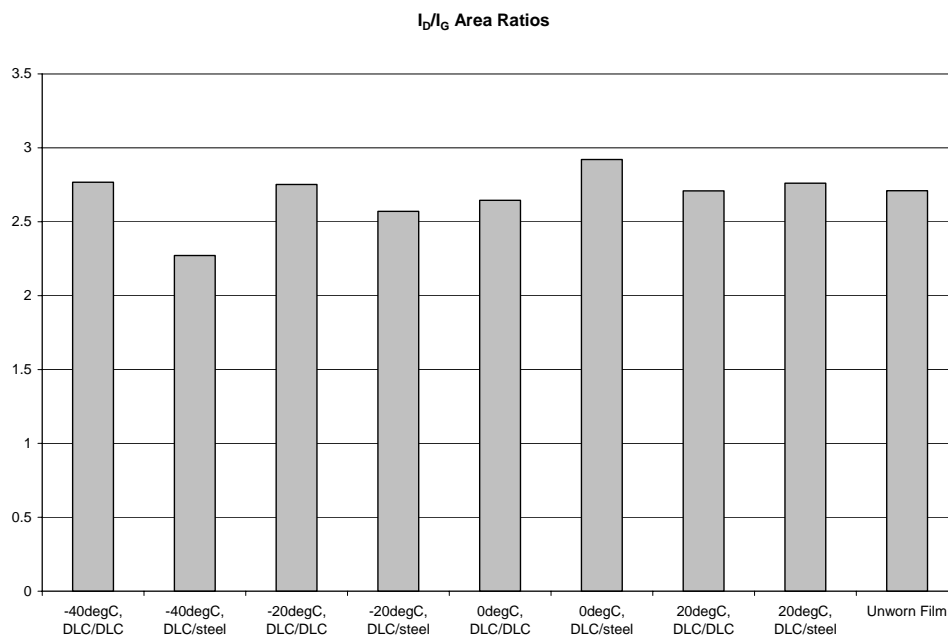


Figure 1. Raman D/G peak area ratios for DLC film worn with different counterfaces and temperatures, compared to unworn film.

REFERENCES

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